

STATE OF ILLINOIS
HIGHWAY COMMISSION
BULLETIN NO. 4.

Crushed Stone Prepared by
Convict Labor

and

Rules for Its Use.

COMMISSION

EDMUND J. JAMES, Chairman,
JOSEPH A. FULKERSON,
LAFAYETTE FUNK.

A. N. JOHNSON, State Engineer.

Springfield, Illinois,
March, 1909.



SPRINGFIELD, ILLINOIS:
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THE HISTORICAL SURVEY

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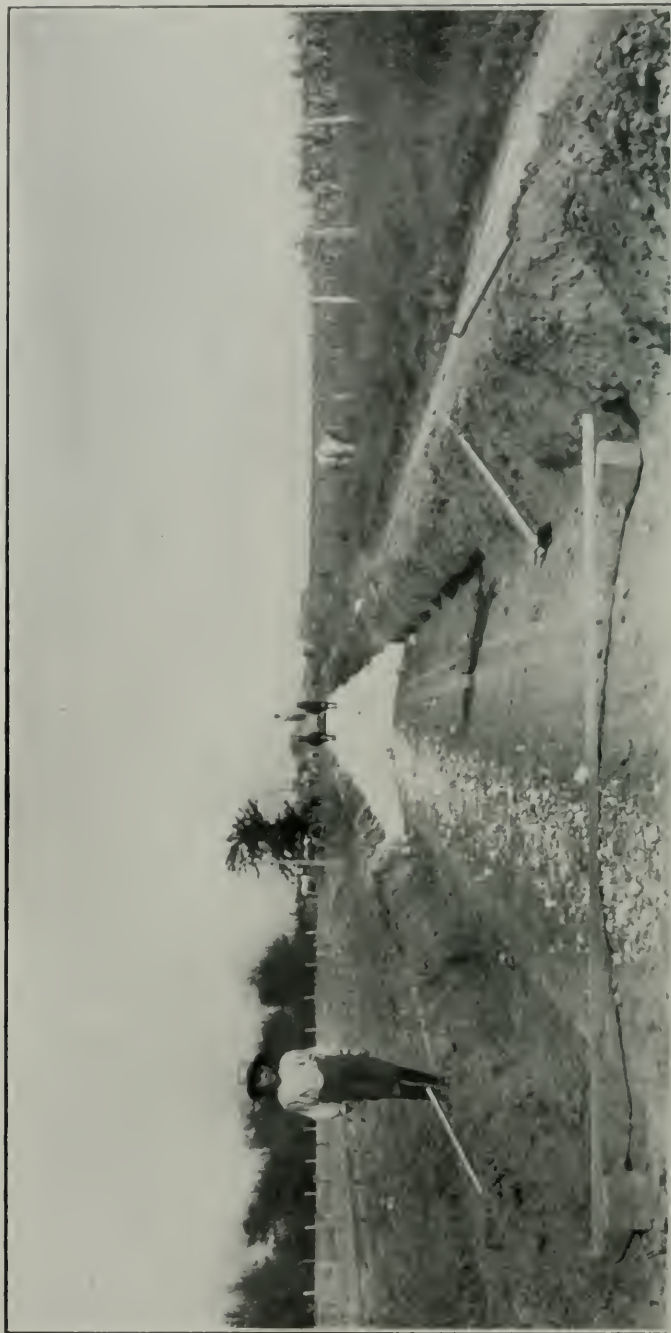
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Properly shaped subgrade, ready to spread first course of stone. The stone should not be spread until the roadbed has been properly prepared.
Be careful to line out the sides straight as done here. Don't have one side of the roadbed lower than the other. If the roadbed is true to shape, there will be no trouble properly to finish the surface.

Crushed Stone Prepared at the Penitentiaries.

LAW REGARDING CONVICT LABOR ON ROAD MATERIAL, ETC.

AN ACT to amend section 2 of an Act entitled, "An Act authorizing and empowering the employment of convicts and prisoners in the penal and reformatory institutions of the State of Illinois in the manufacture of tile and culvert pipe for road drainage purposes, and in the manufacture of machinery, tools and appliances for the building, maintaining and repairing of the wagon roads of the State, and for preparing road building and ballasting material, upon the requisition of the State Highway Commission," approved May 18, 1905, in force July 1, 1905.

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That section 2 of an Act entitled, "An Act authorizing and empowering the employment of convicts and prisoners in the penal and reformatory institutions of the State of Illinois in the manufacture of tile and culvert pipe for road drainage purposes, and in the manufacture of machinery, tools and appliances for the building, maintaining and repairing of the wagon roads of the State; and for preparing road building and ballasting material upon the requisition of the State Highway Commission," approved May 18, 1905, in force July 1, 1905, be and the same is hereby amended so as to read as follows:

§ 2. The commissioners of highways in any township in counties under township organization or the commissioners of highways or boards of county commissioners in counties not under township organization, may make application to the said State Highway Commission for such road building material, tile, culvert pipe, road making machinery, tools and other appliances as may be needed or required by them for the construction, improvement or repairing of the wagon roads in their respective townships or road districts, and where by agreement of the commissioners of highways in counties under township organization, or the commissioners of highways or boards of county commissioners in counties not under township organization, as the case may be, with the city council of any city, or the board of trustees of any village within the limits of such town, any gravel, rock, macadam or other hard road is extended within or through the corporate limits of such city or village then for the construction, improvement or repairing of so much of said road as lies within the corporate limits of such city or village, provided such extension within such city or village shall be of the same cost and kind of material as the road outside such city or village, obligating themselves to use such material according to the rules and regulations formulated and approved by the State Highway Commission.

APPROVED June 3, 1907.

REVISED LAW CONCERNING THE USE OF FREE MACADAM.

The law which provides for the distribution of crushed stone, prepared at the penitentiaries has been amended so that this material may be used inside the corporate limits of villages and cities, provided it is used in extending a road from the township into the corporation, and that the township officials give their consent for the material to be so used.

CONVICT LABOR PREPARES CRUSHED STONE.

The employment of convict labor in preparing crushed stone has so far proved satisfactory.

Many inquiries have been received from other states in regard to the details of this plan, which it is believed is one of the most practical ways of employing convict labor in road construction. In a number of states, more particularly in some southern states it has been the practice to work the convicts on the road itself, and especially in North Carolina and Georgia a number of miles of road have been built very successfully in this way.

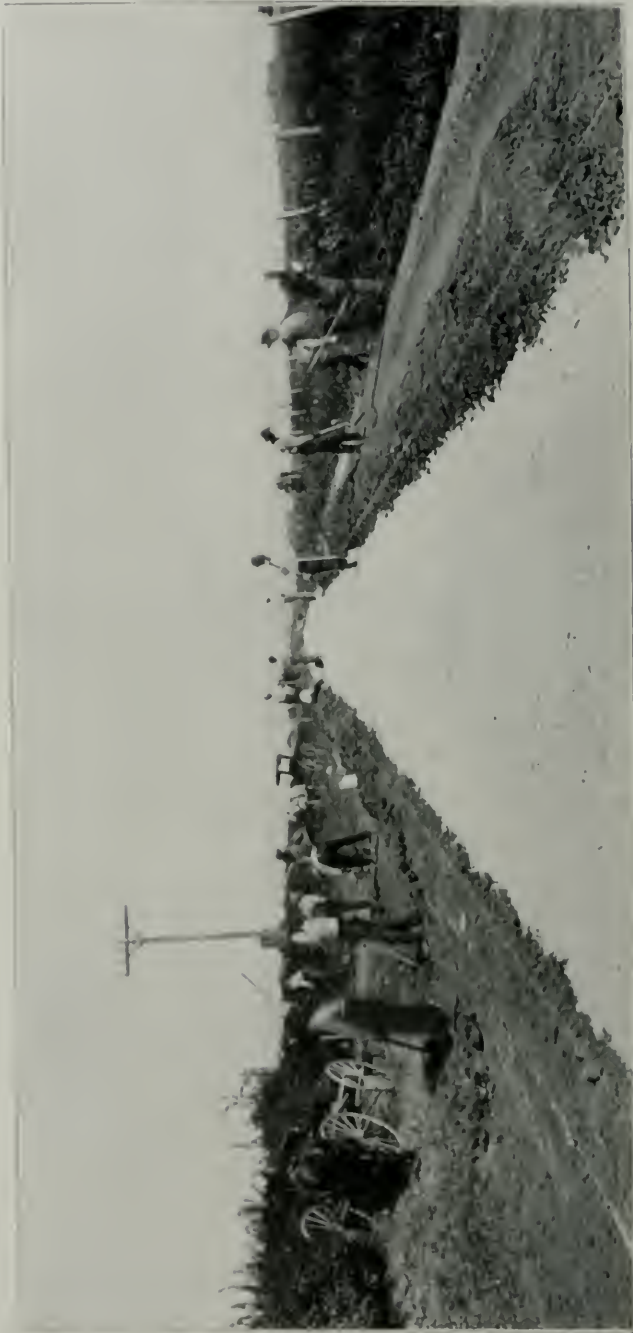
There is, however, in most sections of the country a natural prejudice against exposing convicts on the public roads. It does not seem justifiable to place the opportunity for escape so alluringly before the prisoner and to impose as a penalty on his very natural desire to seize this opportunity the risk of being shot by armed guards stationed at a considerable distance, as a protection against a sudden rush upon them. If a sufficient number of guards were provided to render the use of rifles unnecessary, it would be found that the cost of paying the guards would more than compensate for the reduced cost of the convict labor, so that in the end the work would probably cost more than if performed with free labor.

Another, and perhaps more important, consideration would be the very natural feeling that the laboring man would have against competing with convict labor which, moreover, would bring this class of work into more or less disrepute.

But the employment of the convicts inside the penitentiaries or within stockades, where they are not exposed to public view, and where the methods of guarding and other precautions taken against escape are practically the same as would be necessary whether the prisoners were idle or employed, seems both humane and practical. Under these conditions, there is no additional cost to the taxpayers at large for the product of their labor, so that whatever is produced by their industry is so much gained by the community. Moreover, preparing the crushed stone interferes, in this State, with no existing industry as the crushed stone is, in almost every instance, used in places where it would not be tried unless it could be secured at the specially low rates that this method of production secures. In fact, it can truly be said that the State, rather than interfering with an existing industry is in reality creating an industry, for the total amount of crushed stone, even if all the convicts were employed, would at the most be very small when compared to that which would be necessary should any general scheme of road improvement be undertaken, even in but a few localities.

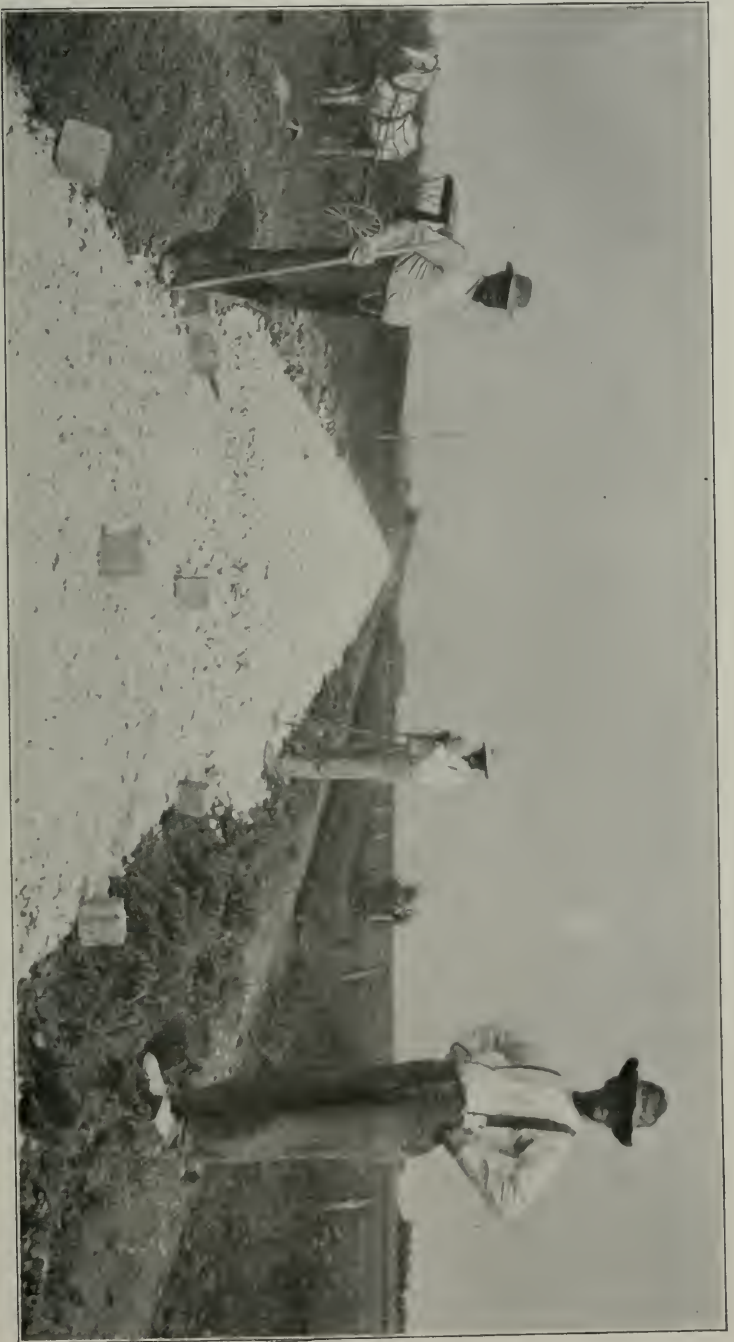
Neither is free labor in any wise brought into unfair competition; on the contrary, work for free labor is created in constructing the roads, which, in many instances, would not otherwise be undertaken.

There is also another point of view which recommends this method of cooperation from the fact that no locality is at any increased expense for the benefits that certain communities, which secured the crushed stone prepared in this way, may derive; nor would the ex-



This shows the first course of stone spread and men at work forming shoulders. They should be formed before the second course is placed.

First course spread, shoulders in place, and spreading second course. Note the blocks which are used to gauge the stone, insuring an even thickness. Round blocks are better than square, unless all edges are same length, as no mistake will then be made by a block turning on its side.



pense to any community be less if no one received the crushed rock, so that it is difficult to see how a more equitable plan of coöperation could be devised.

ADDITIONAL CRUSHERS NEEDED.

There is a great demand for the material, far greater than the present capacity of the crushers can furnish, and it would seem if this work is to be carried on that some means should be devised whereby a certain number of convicts could be established at other places and stone depots opened. If such depots are established, two points must necessarily be borne in mind: First, that the material is of suitable quality and in sufficient quantity, and second, that transportation facilities are at hand. In general, a quarry would be more advantageously located if it were possible to ship the stone in the direction of the empty coal car movement, which would be of considerable advantage in inducing the railroads to maintain low freight rates.

Rules Governing Distribution of Crushed Stone.

1. All applications must be made on the regular forms furnished by the State Highway Commission.

2. Each application for material shall be signed by the local highway commissioners, who thereby agree that the material will be used according to the rules and regulations prescribed by the State Highway Commission as required by law.

3. The State Highway Commission will maintain a general supervision of all work where material furnished by the commission is used.

4. The general method of construction to be followed has been outlined and printed. These instructions will be supplemented by the State Engineer by such further directions as the special conditions in individual cases may require.

5. If it should be found that the material supplied by the commission is not used in accordance with its plans and directions as made by the State Highway Engineer, further delivery of such material will stop immediately on the order of the State Highway Engineer and will not again be continued under the same application unless so ordered by the State Highway Commission.

6. In all cases where the shipment of material has been stopped through non-compliance with the regulations of the commission, the local authorities may apply anew to continue the shipments, but this application will be taken up in turn with other applications that may be on file.

7. Before any application will be considered by the State Highway Commission the local officials making the application for material must give such information concerning the proposed work on which said material is to be used as will satisfy the commission that the proposed improvement will be for the benefit of the general public.

8. The State Highway Engineer shall, before an application for stone is granted, visit the site of the proposed improvement, confer with the local highway officials, and report to the State Highway Commission his recommendation in relation to the application in question.

9. No application for less than 1,000 cubic yards of stone will be considered.

10. No township, or district (in counties not under township organization) shall receive in any twelve consecutive months, unless otherwise ordered by the commission, more than 3,000 cubic yards of stone.



As soon as second course is spread, haul over it all possible and rake in ruts as soon as well defined. Note how the shoulders have been shaped.

unless no other applications are on file on which shipments can be made, and this rule shall apply whether the stone be ordered by township or county officials.

11. After the date of the approval of these rules and regulations by the State Highway Commission, all applications for stone on file, or subsequently received at the office of the commission shall be numbered consecutively in the order of their receipt; and, so far as practicable, shall be approved and filed in the same order. It is, however, understood that before any application for free material shall be approved, the local authorities making application must give ample evidence of their intention and ability to use said material in accordance with the requirements of the State Highway Commission.

12. It is to be understood that the State Highway Commission will give preference to those applications from points at which experimental work is under consideration, and that shipments to such points may be undertaken irrespective of the date of the application for the crushed stone.

13. Experimental work is not undertaken by the State Highway Commission unless a special petition for such work has been filed by the local highway commissioners, accompanied by a request signed by at least twelve farmers or business men in the community where the road is to be located. The petition to be signed by the local highway commissioners must be on the regular blank forms furnished by the State Highway Commission.

14. Before any shipment is made, the State Highway Commission will ascertain the freight rate, the lowest it has been able to secure, and notify the local officials accordingly.

15. Before any shipments are made notice will be given the local officials who may, if they find they cannot receive the stone at the time designated, notify the State Highway Commission to delay shipments. If this is done, no shipment will be made, but the officials by so doing will lose their turn and will have to await such a time before stone will be sent as though their application was of the date shipments were ordered stopped by them.

Instructions for Making Limestone Macadam Roads Without Use of a Steam Roller.

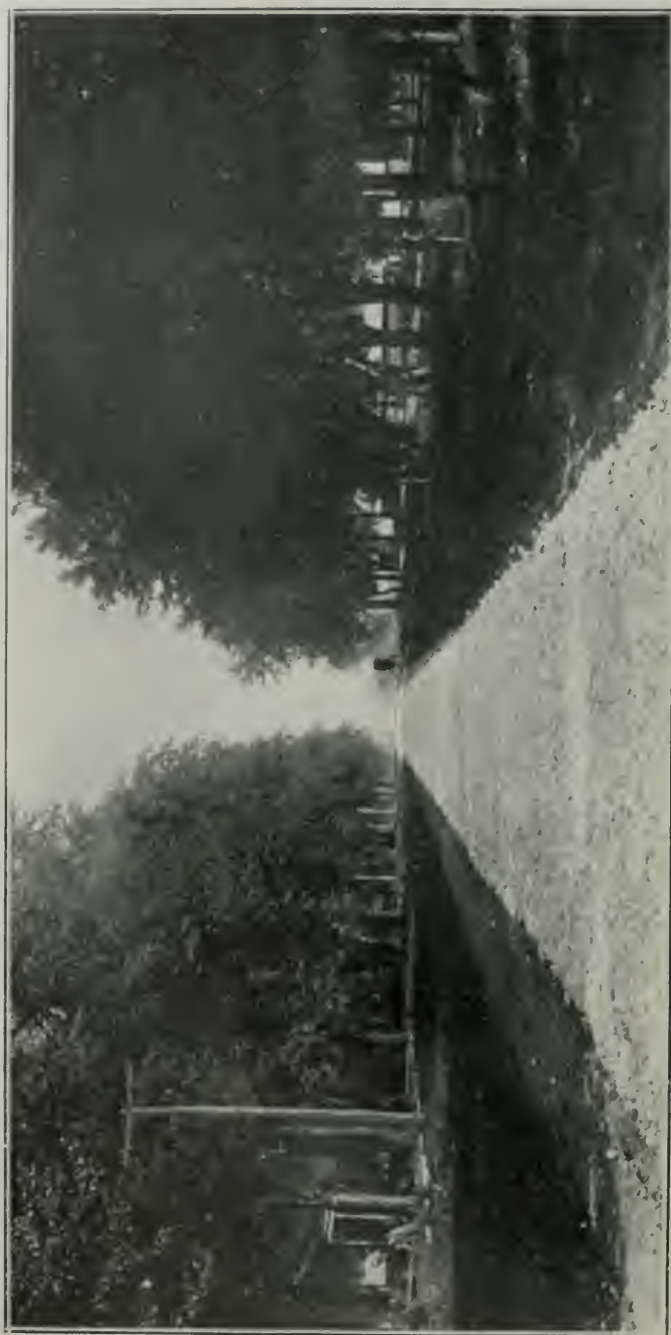
Many inquiries have been received as to the method to be followed in placing macadam material on a road. There is some difficulty in giving precise directions which would cover all cases. The object has always been, when crushed stone has been furnished by the commission from the penitentiaries to have the work done better if possible than similar work had been done before in a particular locality. In most instances, however, it is the first experience of the local commissioners with this class of work. Also there is usually but a small amount of money at hand so that the best methods and best results are not always obtainable.

In but one or two instances have townships owned rollers so that all instructions for placing macadam are given, bearing in mind that a roller is not at hand and that the work must be done to the best advantage possible omitting this very desirable feature. Some of the directions are most forcibly impressed by citing a few "don'ts."

PREPARING THE ROAD BED.

There is a great temptation not to give the proper care to the preparation of the road on which the crushed stone is to be placed and we have frequently to repeat, don't put crushed stone on a road until it has been properly rounded and graded up and all holes and depressions filled. Don't fill depressions or mud holes with crushed stone. Earth is the proper material to use and it is very much cheaper.

The first step therefore is to prepare the road to receive the crushed stone. This is quickly done with a road machine or grader operated in such a manner that the earth is thrown outside rather than to the inside of the road. This is very readily accomplished if a furrow is first plowed with the land side towards the outside of the road. The furrow should outline the edge of the macadam. The blade of the road machine is set so that it throws a small ridge of earth to the outside of the road, leaving the center portion as nearly undisturbed as possible. The width of the road-bed shaped in this manner should be about 10 or 12 feet or the same width that it is proposed to have the macadam. The center of the road should be about six inches higher than at the side on a 12 foot road. It is well to have this part of the work done as much ahead as possible so that the traffic can roll the road-bed and compact



This shows a road ready for the screenings or binder course. An example of careful work. Note how straight the edge of the stone is and how well graded are the shoulders.



A. How not to spread stone. It costs scarcely any more to keep the edges even and straight.



B. Do not let your road get in this condition. Ruts like these will form unless care is taken to rake in loose stone as often as ruts form. Compare this with plates 9B and 10.

it especially wherever it has been necessary to fill depressions. If the traffic cuts the road very much, a road grader should be used to smooth it immediately before the stone is spread.

SIDE DITCHES.

Where the road is through level country, the side ditches should be broad and approximately 30 inches below the center of the finished road. The slope of the side of the ditch towards the road should be about one foot fall to every four feet horizontal, and the side of the ditch towards the fence or the outside of the road could have a somewhat steeper slope, about one foot to every two feet. Ditches made in this manner do not cave in every spring. It is only necessary to cut the weeds to keep such a ditch in good shape. The shoulders and ditches should, if possible, be sown with grass seed or if this is not practicable see that the weeds are cut early in the season and kept cut so as not to smother the grass which will eventually come up and form a close sod which is a great protection to the sides of the ditches and the shoulders as well as adding greatly to the appearance of the road.

EMBANKMENTS.

Through low swampy places, a satisfactory road can be built only by first throwing up a suitable embankment so that the road bed is raised above the general level by at least 18 inches and should be high enough so as to be well above all ordinary water that may stand alongside the road. The embankment should be not less than 22 feet wide on top, preferably 25 feet, and should have as gradually sloping sides as possible. To build an embankment properly the earth should be spread in layers of not over 12 inches thick and wagons and teams driven over all parts of it so that it will become compacted as much as possible during construction. The earth should be spread at first to the total width that it is necessary to make the embankment, including the slopes. For example, if the embankment is to be 25 feet wide at the top and is to be built 4 feet high and the side slopes are to be two horizontal to one vertical, it is evident that the embankment will extend to each side of the road for eight feet so that the distance from the toe of one slope to the toe of the other will be 16 feet plus 25 feet or 41 feet. Very often the embankment is constructed by spreading the earth on the bottom merely for the width that it is desired for the top of the embankment which is built up, and slopes made by dumping the earth over the edge. This will not give as solid an embankment nor one that will hold its shape as well.

CONSTRUCTION OF SHOULDERS.

The earth which is thrown up at the sides and forms the shoulders prevents the stone spreading and the traffic displacing the edge of the stone. The shoulders should be formed before the stone is spread. In a number of instances the stone has been placed upon the road with no attempt whatever to form shoulders. This is not the right way.



Spreading the screenings with shovels from piles alongside the road. The second course of stone has been spread, shoulders leveled and all ruts raked in. It is well to leave the road without screenings as long as possible and then put them on during a rain.

After the second layer of stone has been spread, the earth shoulders should be smoothed down to conform to the surface of the road and should be sloped towards the gutters with a slope of one inch to the foot for at least a width of 4 feet on both sides of the stone.

BLIND SIDE-DRAINS AND UNDER-DRAINS.

The cut shown in Figure 1 illustrates the various steps here described. As the work progresses, there should be cut through the shoulders at intervals of about 50 feet, trenches about the width of a shovel and to such a depth that the water will run readily from the road-bed to the side ditches. These trenches should be filled with broken stone or gravel, whichever may be at hand, and about the same thickness as the layer of stone in the first course. The remainder of the trench is filled with earth so that these drains do not show on the surface of the shoulder. The side drains and shoulder drains tend to keep the road-bed dry and also to drain the shoulders and are, in no case, to be omitted.

If there is under ground water as shown by a seepy or quaky place, it will be necessary to run a tile drain through such places and carry it to an outlet in the side ditches. If this is not done, no amount of stone which could be put in such a place will be effective to prevent a mud-hole from eventually forming. In very level country where good drainage is difficult to secure, it is important to have the center of the road elevated as much as possible so that the foundation of broken stone will at all times be well above the level of the water in the side ditches.

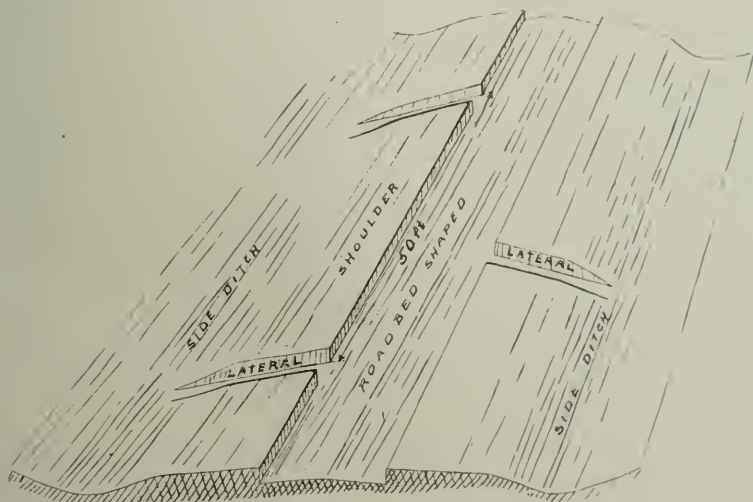


Figure No. 2—Sketch illustrating position of lateral drains, which should be cut as soon as roadbed is shaped so as to drain water from the roadbed to the side ditches.

SPREADING FIRST COURSE OF STONE.

The second step is to spread the first course of stone.

If it is planned to put a 10-inch layer on the road, don't put it all on in one layer. It should be put on in two layers. As practically all the stone obtainable in Illinois is limestone which is but moderately hard, it is better to reverse the usual order of making a stone road and put in the first course or on the bottom of the road the 1½ inch size material which should be evenly spread for a thickness of four to five inches. A strong-toothed rake is one of the best implements of the road maker. Stone that is spread by a rake will be stirred up and the small pieces will take their natural position at the bottom of the layer and the stone will, therefore, compact very much more quickly and the larger pieces will not tend to work to the surface as they will inevitably do if placed at the bottom. As they come to the surface the whole layer is disturbed and loosened.

A strong toothed harrow is recommended as an excellent means to settle the stone in place after it has been evenly spread. Each layer of stone should be harrowed thoroughly.

SPREADING SECOND COURSE OF STONE.

The next step is to spread the second layer or top course. This should consist of the three inch material which is evenly spread with rakes as in the case of the lower course of stone.

A word should be said about method used to spread stone. The essential thing is to get an even layer of material. This cannot be done if the stone is raked from a pile as it is dumped upon the road as the center of a pile of stone is always more compact than the material that is raked to the edges. It is therefore, necessary to see that all the stone is rehandled.

A very convenient way to measure the thickness to which the stone is spread is by blocks of wood. If the material is to be spread 5 inches thick, then the blocks should be cut to measure 5 inches in all dimensions so that no matter which way the block may be set, it will be five inches high. At least twelve of these blocks should be made. They should be set three in a row upon the roadbed, one in the center and one on either side. Three more should be placed across the roadbed in a similar position about six or eight feet from the first row. As soon as the stone is spread around the first row of blocks, they are taken out and set ahead and the process repeated. There should be a similar set of blocks for each layer of stone. As before noted, the road-bed should be shaped true enough so as not to require more stone in one place than in another to secure an even surface.

Stone cannot be spread "by eye." When it is borne in mind that a variation of but one inch in thickness means 244 tons per mile of road, 12 feet wide, the importance of using only so much material as is necessary is evident.



This shows road with screenings spread. Notice ruts are beginning to form. When road gets in this condition, the ruts should be filled in immediately after the first good rain. A road drag can be used for this purpose. Don't let the ruts form.



A. Using road drag to smooth the surface and fill in incipient ruts. If ruts become an inch or two deep it will be necessary to fill them with pieces of stone as the screenings will soon grind up and blow away.



B. This shows a finished road. Note how the hills have been cut and hollows filled to make an even grade.

Sometimes stakes are set on either side of the road and a string stretched from one to the other. The stone can be very evenly spread by this method but it is far more bother than the use of the blocks and is no more accurate.

SCREENINGS OR BINDER COURSE.

After the last or second course is spread and the shoulders have been formed, the road is ready for the screenings or stone dust. Each shovelful of screenings should be spread in such a manner that it will cover as large an area as possible, thus sweeping the screenings into the interstices of the broken stone. Only a part of the screenings should be put on at first. Allow the traffic to go over the road for a week then fill the ruts with stone and put on more screenings in those places where it is shown that they are needed. A small amount of fine gravel makes an excellent binder for limestone.

FILLING RUTS.

It will be necessary in order to obtain good results that a man be employed to go over the road frequently and as fast as ruts are formed see that stone is raked into these ruts and they are kept filled. If this is done throughout the first season the road will eventually become compacted and fairly smooth and a satisfactory surface will result particularly where limestone is used which is comparatively soft and binds readily. Do not attempt to fill a rut or depression in a macadam road with screenings or pieces of stone that are smaller than those used in the construction of the upper course.

INSTRUCTIONS FOR PLACING GRAVEL.

Gravel roads should be built in much the same manner as already outlined for building macadam roads. Particular attention should be paid to thoroughly spreading and raking the gravel so that the finer parts are sifted to the bottom leaving a layer of the larger pebbles and pieces of stone on the top to form a wearing surface.

There are many cases where the gravel is found very close at hand but of such sandy nature that it will not form a good road surface. Such gravel can, however, be used to advantage at the bottom of the road which could then be covered with a four or five inch layer of crushed stone. In this way the crushed stone would go very much further than if the road was built entirely of stone. A small amount of fine gravel makes a good binder for a layer of limestone, in fact it has been found to give a better bond than is obtained with limestone screenings alone.

The usual method of dumping one load of gravel at the side of another and leaving the traffic to spread and compact it causes far too much inconvenience to traffic and should not be permitted.

The question is frequently raised whether macadam or gravel should be spread in the center of the road or at one side, having an earth road on one side and gravel on the other. The best practice is to place the macadam or gravel in the center and, if there is sufficient room, a side

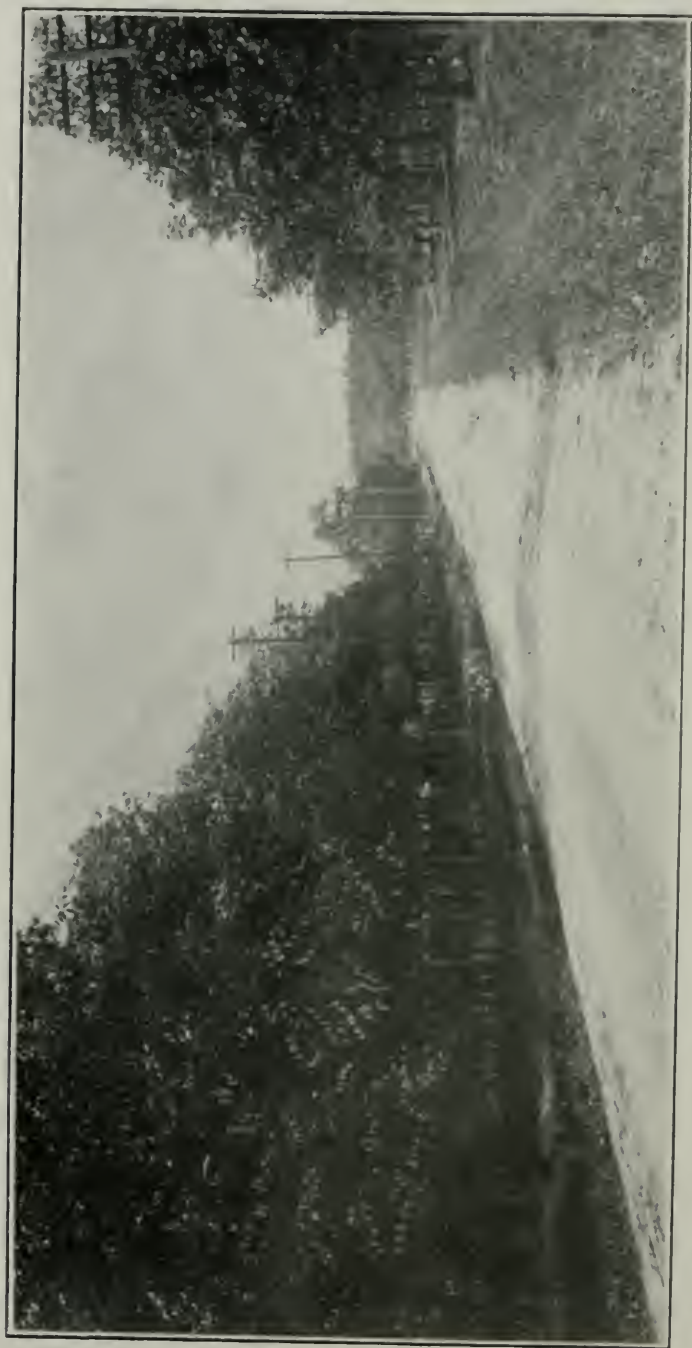
road can be made on either side. In nearly every instance observed where the gravel road is at one side and the earth road at the other, the earth road, wherever it was used to any extent, was soon worn down considerably below the gravel or macadam so as to form a terrace that prevents traffic from turning readily from the gravel to the earth road or vice versa. This makes it more difficult to provide for proper drainage; moreover a road constructed in this manner always presents an unsightly appearance.

CARE OF THE ROAD SIDE.

Appearance counts. It is worth as much to the road as to the houses and grounds alongside it. A beautiful road-side attracts people and enhances the value of the property in the neighborhood.

The first thing to be encouraged is the growth of a good sod from the edge of the traveled way to the fence line. Keep the weeds cut and give the grass a chance to grow. Where there are no trees, set them out. There is an opinion in the minds of many that trees harm a road, claiming that they retain the moisture and are in other ways baneful. Wherever the road is bad in the neighborhood of trees, the trouble is not with the trees but with the road. If the road were properly constructed and drained, the trees would cause no further trouble. In fact, with a macadam road, the moisture that would be held in the surface in the summer time would be a distinct advantage. In the winter time, if the low-hanging limbs are trimmed, there will be practically as much sun and wind come upon the road as though there were no trees, while their value in the summer time cannot be over stated.

Trees along the road side should not be cut down at the caprice of an individual commissioner or even of the land owner alongside. Trees are a public asset and should be most jealously guarded and cut only after due consideration by public officials who should be chosen for this purpose, or have these duties imposed upon existing public officials, but in any event, prevent the wanton destruction of beautiful shade trees on the road side. Care for the trees you have, set out new ones; it pays.



Another completed road. You can get just as good results if you will watch your road and not let the ruts form. Don't imagine that as soon as the stone is spread the road is finished and "permanent." It will be necessary to fill in the ruts occasionally for the first six months or so. After the first winter and spring watch for any depressions and fill them with stone.

